ought to be. In describing the tests for barium it is said that the bead "can be flamed," but no explanation is given of the process of flaming. The capital test for bismuth with potassium iodide and sulphur is entirely ignored.

I now come to the third part, which treats of quantitative assays. Mr. Attwood's plan of making a check assay in every case with a small quantity of the pure metal is certainly calculated to give the operator confidence in his results. The author adopts 1½ grain as the amount of ore to be taken for an assay. I think he would have done better to have followed Plattner and used the French weights, because there is less chance of making errors where each milligramme means 1 per cent.

For the silver assay Mr. Attwood employs pieces of ordinary charcoal instead of the far more convenient and portable charcoal crucibles designed by Plattner. He also describes a crucible assay for silver ores, which does not appear to possess any advantage over Plattner's scorification method.

There is one most unfortunate error in the book to which I feel bound to call attention. Mr. Attwood gives some tables for calculating the number of ounces of gold or silver per ton from the results of assays of 1½ grain of the ore. In an unlucky moment he forgot that gold and silver are weighed by *troy* weight, and calculated his tables for *avoirdupois* ounces. The consequence is that these tables are not only valueless, but also highly misleading. Let us take one case as an example. Suppose that 1½ grain of ore had yielded 0·01 grain of fine metal. We look down the table (p. 117), and find, according to Mr. Attwood, that the yield would be 238·93 oz. per ton; in reality the yield should be 217·77 oz.

Some neat little retorts have been designed by the author for distilling ores of mercury and amalgam, but he does not mention Küstel's assay.

On coming to the tin assay we have the peculiar statement that silica may be separated from tin ore by boiling t with hydrochloric acid. "The assay being finely powdered, the silica is dissolved." "The dissolved silica is decanted off" (p. 158). Cornish mine agents will be surprised when they are told that, in order to obtain correct results, it is necessary to wash or van as much as *5 lbs.* of an ordinary tin ore (p. 159).

Under the head of nickel no mention is made of the valuable ores from New Caledonia.

Small mistakes are numerous. The size of a box is said to be "twelve inches square" (p. 3); we note also: "*a* most useful addend*a*" (p. 24); "chloride of ammoni*a*" (p. 33); "mangan*ite*" instead of manganate (p. 53), and permanganate (p. 54). The term "raw iron" is used frequently instead of "pig iron," and shows that the author has copied Cornwall's translation blindly. Coal, anthracite, and graphite are said to "volatilise" when heated in the platinum spoon (p. 82). Sieves are made with 2000 holes per "linear" inch (pp. 100 and 137). In the description of cupellation (p. 106) we read: "The lead parts with portions of its oxygen to the copper and other base metals."

In conclusion I think that the value of the book would be increased if a list of *errata et corrigenda* were inserted, correcting some of the errors which, I regret to say, impair its general usefulness. C. LE NEVE FOSTER

OUR BOOK SHELF

Über die von den Trichopterenlarven der Provinz Santa Catharina verfertigen Gehäuse. Von Dr. Fritz Müller. *Archivos de Museu national.* Vol. iii. pp. 99-134, and 209-214. Rio de Janeiro, 1880. (Aus dem Portugieischen übersetzt von dem Bruder des Verfassers, Dr. Hermann Müller in Lippstadt.)

DR. FRITZ MULLER has for some years been engaged upon an investigation of the habits of the Caddis-flies of Santa Catharina, and has shown extraordinary skill in breeding these insects, a matter always difficult, and especially in the case of those that inhabit running water. The results of his researches were foreshadowed in various notes published in the *Zoologischer Anzeiger* and in the *Transactions* of the Entomological Society of London for 1879. But it was well known that the extended information and figures would be given in the Rio de Janeiro *Archivos*. As this publication is somewhat difficult to obtain, and as most of us are not familiar with Portuguese, Dr. Hermann Müller has conferred a great boon by publishing a translation of the paper (accompanied by the two folded plates) in the *Zeitschrift für wissenschaftliche Zoologie* for the present year (pp. 47-87, plates iv. and v.). It is needless to state that the details are of the greatest interest, and we have here the most important contribution to the natural history of *Trichoptera* that has appeared since the publication of Pictet's "Recherches" on the species of Geneva, and worked out in a far superior manner. We cannot here even allude to most of the many marvels of insect-architecture and habits that Dr. Fritz Müller has revealed. Some of the most interesting are the numerous forms of *Helicopsyche*, which build little sand-cases so like shells that they have been described as such; those *Dentalium*-like cases, originally noticed by Aug. St. Hilaire as *Grumicha*, which name our author retains; those instances of parasitism (or worse) in which a larva of one species dispossesses that of another of its house and converts it to its own purposes; those very numerous forms of *Hydroptilidæ*, the most minute of all *Trichoptera*, with cases of the most varied and wonderful structure; above all, that most interesting fact that the rain-water which collects at the bases of the leaves of some *Bromeliacæ* has a special fauna of its own, including at least one Caddis-worm. The descriptions of these and many others will be read with delight by every biological student; and we hope Dr. Müller will follow up the paper by records of further discoveries, for here, as in all his works, the evidences of superior powers of observation strike one on every page.

The plates are excellent, and aid much in a realisation of the descriptive portion. Dr. Müller's artistic powers are so marked that we cannot but regret he has not furnished details of the form and structure of the perfect insects also, which would have greatly aided systematists; in fact the perfect insects are only alluded to in a casual manner.

Voyages of the Elizabethan Seamen to America. Thirteen Original Narratives from the Collection of Hakluyt, Selected and Edited, with Historical Notices, by E. J. Payne, M.A. (London: De La Rue and Co., 1880.)

WE do not quite understand Mr. Payne's reason for publishing this selection from Hakluyt's classical collection of voyages. The selection is, however, judicious, and cannot fail to be interesting, and at the same time instructive, to those who desire to become familiar with the first beginnings of English conquest in America. Mr. Payne's familiarity with the subject of British colonisation, as exemplified in his excellent little "History of European Colonies," specially qualifies him for making such a selection as the present. His brief Historical Introduction enables the reader to understand the special significance of the voyages contained in this volume. He

shows the various causes in operation at the time to instigate such voyages, causes mainly political and commercial. Other influences were however at work, not the least of which was "the total transformation which astronomy and geography had undergone" during the sixteenth century. The narratives here given are those of Hawkins's and Frobisher's three voyages, Drake's voyages of 1577 and 1585, Gilbert's voyage of 1583, Amadas and Barlow's voyage, 1584; Cavendish's first and last voyages, and Raleigh's voyage to Guiana. Prefixed to each narrative is a short historical introduction.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Black Sheep

THE following extract of a letter from Mr. Sanderson of Chislehurst, who permits me to publish it, seems worth placing on record. It relates to the former frequent appearance of spotted or black sheep in the Australian flocks, as long as animals thus coloured were of use to man, although they were never, as far as Mr. Sanderson knows, separately bred from, and certainly not in his own case. On the other hand, as soon as coloured sheep ceased to be of use they were no longer allowed to grow up, and their numbers rapidly decreased. I have elsewhere assigned reasons for the belief that the occasional appearance of dark-coloured or piebald sheep is due to reversion to the primeval colouring of the species. This tendency to reversion appears to be most difficult quite to eradicate, and quickly to gain in strength if there is no selection. Mr. Sanderson writes:—"In the early days before fences were erected and when shepherds had charge of very large flocks (occasionally 4000 or 5000) it was important to have a few sheep easily noticed amongst the rest; and hence the value of a certain number of black or partly black sheep, so that coloured lambs were then carefully preserved. It was easy to count ten or a dozen such sheep in a flock, and when one was missing it was pretty safe to conclude that a good many had strayed with it, so that the shepherd really kept count of his flock by counting his speckled sheep. As fences were erected the flocks were made smaller, and the necessity for having these spotted sheep passed away. Their wool also being of small value the practice soon grew of killing them off as lambs, or so young that they had small chance of breeding, and it surprised me how at the end of my sheep-farming experience of about eight years the percentage of coloured lambs produced was so much smaller than at the beginning. As the quantity of coloured wool from Australia seems to have much diminished, the above experience would appear to be general." CHARLES DARWIN

The Nature of the Chemical Elements

DR. ARMSTRONG'S article in NATURE, vol. xxiii. p. 141, has brought to my mind some calculations I made more than a year ago to test a theory I had long previously entertained. Most of us who have paid much attention to the subject are agreed that the elements are capable, under exceptional circumstances, of profound chemical change. Mr. Lockyer is searching, with success as it appears, for contemporary evidence of this by examining the condition of the solar surface. The other line of evidence is historical, and turns mainly on the classification of the numerical values of chemical symbols. It is of course only with the latter that I have to deal.

The classifications proposed by Newlands and Mendelejeff are comprehensions of much similar preceding work. They appear to me to be faulty in two ways: (1) on account of the seriously large number of elements they wholly fail to include, and (2) because of the strong stress they lay upon arithmetical series of a rough *per saltum* character. As I do not know of any real case of *per saltum* chemical change, I do not think the elements should be classified on such a basis. What is wanted is a system capable of including—with exactness and not mere approximation—the whole of the elementary numbers; that system to be represented in the mathematical symbols of ordinary chemical change, and therefore free from a *per saltum* character. I have to a great extent succeeded in finding such a system, and the results of testing it at many points are as follow:—1. There is probably only one fundamental form of matter; and this, as has been previously supposed, yields our ordinary elements and many others by ordinary polymerisation. 2. Almost all the elementary numbers have been tried, and, with the exception of H and Cl, which are a little troublesome, they fall into order very exactly. 3. This order exhibits no discontinuity, and is similar to a case of ordinary chemical change. 4. There is clearly an upper limit to this order; in other words, elementary numbers of more than a certain magnitude appear to be impossible.

Sir B. C. Brodie's method is really a classificatory one; and I with others had been very desirous to read the Third Part of the Calculus, in which it was promised ampler play. It will be a matter for much regret if his premature death should have prevented this. But what he did publish was sound and sure: the first real symbols chemistry has yet enjoyed, and the only ones hitherto proposed whereby the process and the results of chemical change admit of unitary as well as kinetical representation.

EDMUND J. MILLS

Smokeless London

As I hope soon to have an opportunity of reading a paper on this subject before a scientific audience I need not occupy your valuable space by replying to your correspondents of last week in detail. I may say however that the scheme has been carried out in practice at a gas-work to which I shall afterwards refer. When it was found that the apparatus for making gas on an extraction of six hours was insufficient for supplying the wants of the long winter evenings the distillation was stopped when gas had been removed to the extent of 5000 cubic feet per ton. The larger quantities obtained from the coal per unit of time and the superior illuminating power obtained per unit of volume tided over the difficulty and rendered the existing plant sufficient. No practical obstacles were discovered in discharging the retorts. I do not think the difference between an extraction of 5000 and 3333 cubic feet per ton would make a material change in this respect. Mr. Mattieu Williams points out a much more serious obstruction in the plethoric indifference of the gas companies. In reply to E. R. F. I may say that the fuel resulting from a uniform extraction of 3333 cubic feet per ton is practically smokeless if it is taken hot from the retorts and immediately quenched with water.

Westminster, December 27 W. D. SCOTT-MONCRIEFF

Colliery Explosions and Coal-Dust

ACCEPTING Mr. Galloway's view that in many mines the extent and destructiveness of colliery explosions are due to the distribution of coal-dust in the air, may I suggest the possibility of preventing the explosion from spreading beyond the sphere of the fire-damp by sprinkling the floors throughout, at certain regular intervals, with mineral oil? A shady road, with one such sprinkling, may be kept free from dust for several weeks during the summer, and the corridors of a mine, not being open to wind and rain, would of course remain wet for a longer period. A saucer filled with dust and treated with mineral oil will retain the oil for months even when exposed to sun and rain. The mixture of coal-dust and oil is quite uninflammable. The experiment may perhaps be worth trying in one of the drier coal-mines.

December 27 R. RUSSELL

Geological Climates

PROF. DUNCAN is under the impression that the claim of *Araucaria Cunninghami* to have flourished at Bournemouth during the Eocene, rests on "a bit of a leafy part of a tree," and that this bit is "squashed." The foliage is however abundant there, occurring almost wherever vegetable remains are found, from the east of Bournemouth Pier to half a mile beyond Boscombe. In one place, where a bluff is literally full of it, the disarticulated branchlets are perfect, and not in the least degree compressed. Again, the determination was not made by Prof. Haughton, but rests upon my statement that this foliage and that of *A. Cunninghami* cannot be distinguished one from the other. That it is Araucarian foliage I am perfectly satisfied; but whether the existing Australian species is identical and unmodified, must remain doubtful until other